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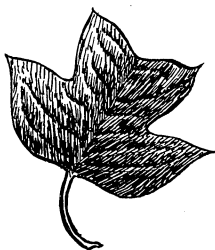
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Notes on Forestry and Wood-use



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Timber Stand Improvement

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Timber Stand Improvement (T.S.I.) is the process of controlling and improving the growth, quality and species composition of a timber stand. The objective of T.S.I. is to develop vigorous, high quality, and high value crop trees which command top market prices. The good high-producing stand should consist almost entirely of high quality trees of the more valuable species. Cull trees and low value species occupy growing space but produce little or no income.

Woodlands must be completely protected from livestock and fire if timber stand improvement is to be effective. Grazing and forest fires reduce tree growth and quality and also favor the invasion of insects, disease and undesirable tree species.

Nearly all Indiana woodlands need timber stand improvement. Forest surveys have shown that over 50 per cent of our saw timber volume is in low quality (grade 3) logs and one of every six saw-timber-size trees is a cull. In many woodlands, low value species and vines are crowding and suppressing pole-size black walnut, tuliptree and other high value trees. The growth rate and quality of crop trees in such stands is much lower than in well-managed woodlands.

The best timber sites should be improved first. These include coves, north and east slopes and the better-drained productive soils. T.S.I. is not recommended on thin dry soils of certain dry ridge tops and southwest slopes. Here, the costs of T.S.I. are high compared to the improvement to be expected. A 30 to 50-foot border around the edge of the woods should also be left untreated. A dense growth of trees, shrubs and vines along the edge will protect the interior from sun and wind, provide food and cover for wildlife, and add natural beauty.

Regenerating Mature Stands

When a stand of timber is mature, it should be harvested in a manner that will provide for the regeneration of a new stand. Since most of the commercially important species such as black walnut, tuliptree and the oaks grow best in full sunlight, woods openings are needed to develop vigorous reproduction. Group, patch or block clear cutting systems are used in harvesting the merchantable trees in a mature stand. Such openings may range from 1/4 acre to several acres in size (Figure 1).

Release of Crop Trees and Thinning

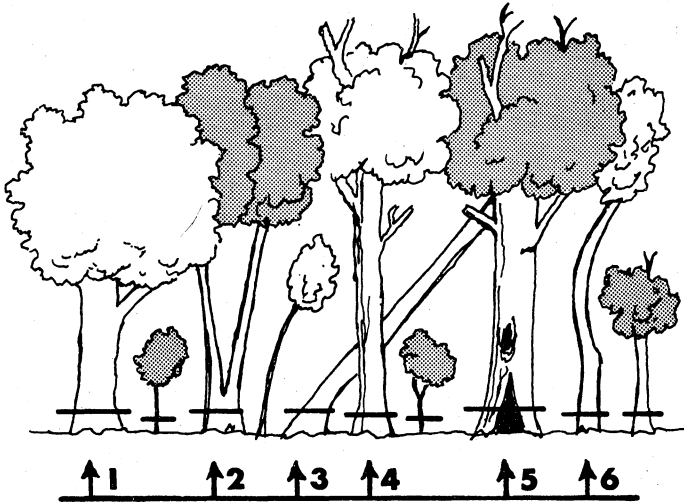


Figure 1. A woods opening is created by a regeneration harvest and T.S.I. Tree #1, a short-bodied wolf tree, and #4, an over-mature two-log tree are harvested for veneer and sawlogs. Tree #2 with multiple stems; #3, a root-spring tree; and #6, crooked and deformed, are cut for small sawlogs, pulpwood or other roundwood products.

Timber stand improvement is needed in conjunction with the harvest operation to remove the non-merchantable trees. Pole size and larger trees left in the openings become wolf trees and suppress new reproduction. Climbing vines which grow rapidly in full sunlight must be controlled to prevent damage to the new stand.

Crop trees should be well formed vigorous trees of desirable species adapted to the site and free of insects, disease or other damage. Potential crop trees should be selected early and can be identified when stands reach sapling or pole size. Where potentially good crop trees are being suppressed by vines or less desirable trees, they must be released to maintain maximum growth and quality. If release is delayed too long, it will not be effective. Pole and small sawtimber-size trees suppressed for several years usually have crooked and partially dead tops and do not respond well to release.

Thinnings, or intermediate harvests, are made periodically throughout the life of the stand. The objective of thinning is to give crop trees additional growing space by removing competing trees of low quality and value. Trees too small to be merchantable may be either cut or killed. Thinnings should be confined to the better timber sites. Pre-commercial thinnings of small oaks on relatively poor sites do not appreciably stimulate growth in the remaining stand.

An early thinning should be directed toward selecting crop trees on a spacing that will be adequate when the trees reach pulpwood or small sawtimber size. Do not

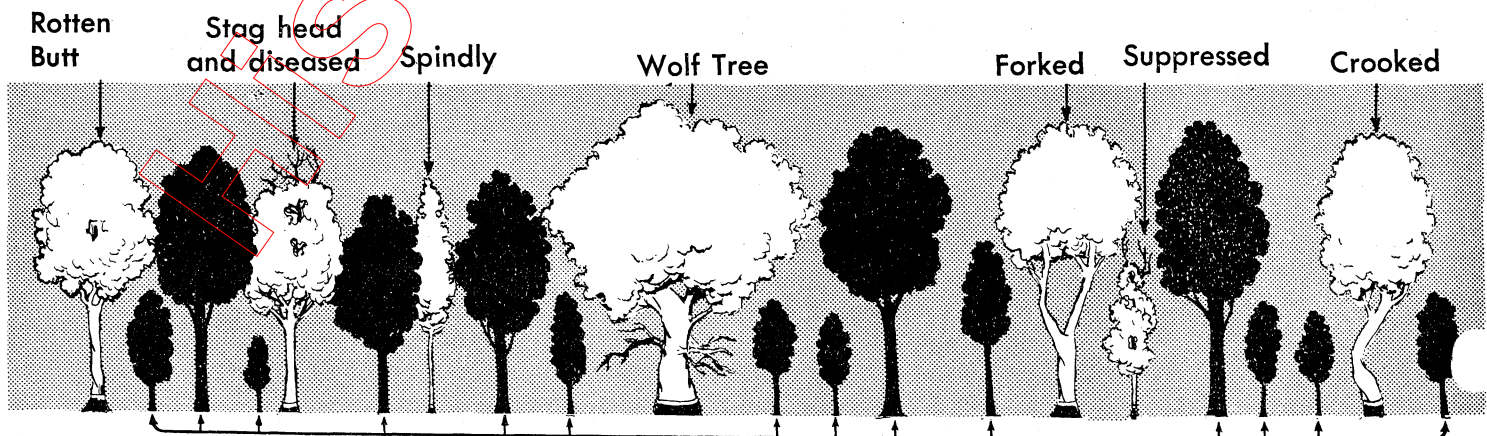


Figure 2. Keep the healthy, full crown trees for future harvests.

The following guide developed by the Central States Forest Experiment Station gives spacings recommended for even-aged upland hardwood stands:

<u>Tree Diameter (DBH) Inches</u>	<u>Spacing Between Crop Trees (feet)</u>	<u>Approx. No. of Trees Per Acre</u>
2	5 to 7	890 - 1740
4	8 to 10	430 - 680
6	11 to 14	220 - 360
8	14 to 18	130 - 220
10	16 to 21	100 - 170
12	19 to 25	70 - 120
14	22 to 29	50 - 90

overthin, as this will waste growing space, encourage bole sprouts and possible damage by sunscald to crop trees.

Pruning Crop Trees

Pruning refers to the removal of lower dead or live branches from crop trees. The major purpose of pruning is to increase the amount of knot-free wood produced in the bottom logs. Crop trees selected for pruning should show promise of producing prime or grade one butt logs when merchantable size is attained. Greatest returns will accrue from pruning high quality trees of high value species on good sites. Good examples are black walnut, white oak and cherry.

Pruning while branches are small (under 2 inches) will permit quick callousing and prevent decay. In general, major pruning should be completed by the time the trees reach 8 inches in diameter. Winter is a good time to prune; however, when small limbs are pruned, the time of year is not important. Remember that sunscald and excessive bole sprouting may result if the pruned trunks are exposed to direct sunlight too quickly. For this reason, pruning is frequently completed in two or three operations over a period of time.

A narrow, curved, single-edged saw, which cuts on the back stroke, is considered

the best to use for pruning. Do not use axes and chisels which may leave branch stubs and damage to the bark. Limbs should be cut flush with the branch collar close to the trunk. Large branches should be undercut to prevent tearing the bark as they fall. In pruning upper branches, a hand saw and lightweight ladder is considered faster than the pole saw. The top rung should be wrapped to prevent damage to the tree trunks.

Black walnut will need corrective pruning annually for the first few years to maintain straight boles. Trees with exceptionally poor form can be cut off at the ground line -- and the best sprout selected later. General pruning of black walnut should begin when plantings are 3 to 5 years of age. Up to 50 per cent of the branches can be removed without a sprouting problem.

Methods of Removing Undesirable Trees and Vines

1. Cutting. If the work will pay for itself in pulpwood, posts, fuelwood, piling or other products, then cut. For large hollow, wolf trees or cull trees, cutting is rarely feasible and often results in considerable damage to nearby trees. When small trees are cut, the base should be sprayed up to 2 feet with a herbicide to prevent sprouting. Do not spray when snow prevents getting to the base of the tree.

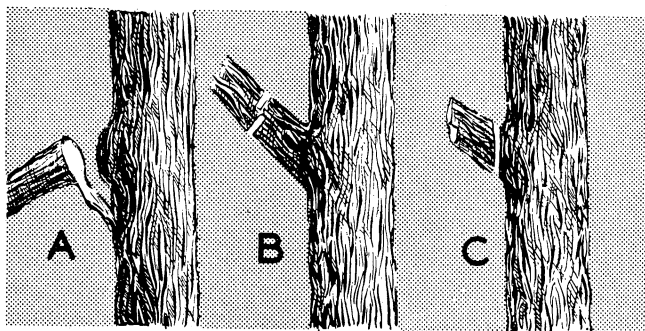


Figure 3. In pruning larger limbs to prevent damage (A), undercut first and then cut off limb (B), remove stub even with trunk (C).

2. Girdling. Girdling with an ax, girdling tool, or a power girdler is effective if the cut is made completely around the tree into the wood. Deadening the tree and leaving it stand allows it to deteriorate gradually with little damage to surrounding trees. Such trees also provide dens for wildlife. The best time to girdle is in late summer or early fall, although it can be done in other seasons. The disadvantage of girdling is that sprouting may occur unless herbicides are used. Also, it is not effective on trees with stump wounds where ingrown bark seams occur.

3. Basal Sprays. Basal spraying with herbicides is effective on trees up to 4 inches in diameter. The spray should be directed at the basal area of the trunk so as to saturate that area from the root crown up to 2 feet all the way around the tree. Respraying might be necessary to complete the kill of sassafras, sumac, elm, tree-of-heaven and other hard-to-kill species. Basal spraying should also be used to kill vines which are growing on valuable trees. Vines often weaken and may kill trees. The lower stem and root crown of the vine should be thoroughly wet with the chemical being careful to prevent the solution from getting on nearby tree trunks.

4. Frilling. Trees more than 4 inches in diameter should be frilled. Frills consist of overlapping deep single hacks into the wood completely around the tree at the lowest

practicable height. The herbicide 2,4,5-T in oil is then applied to the freshly cut frill until all surfaces are wet to the point of overflow. When the tree has wounds or seams of ingrown bark, the frill should be made above the defect.

5. Injection. This is a similar method, using a tree injector tool, by which concentrated herbicide is introduced into the frill as it is cut. The tree injector is a tool with a hollow handle for chemical storage and a sharp bit which delivers a measured amount at each cut. A continuous frill is recommended.

Herbicides

A number of different chemicals may be used to kill unwanted trees. 2,4,5-T in fuel or diesel oil has been effective on a wide variety of tree species and vines and may be applied at any time of the year. Chemicals may be effectively applied by knapsack sprayers and tree injectors.

Chemical Mixtures

The following table gives amounts of 2,4,5-T to use in making 3, 25, 50, and 100 gallons of spray for basal spraying, frilling and treating stumps when 2,4,5-T containing 4 pounds of acid per gallon is used. (The concentration of acid per gallon is given on the label of the container.)

Amount of 2,4,5-T to Use in Oil:

1 pt. in	3 gal. of oil
1 gal. in	25 gal. of oil
2 gal. in	50 gal. of oil
4 gal. in	100 gal. of oil

NOTE: Use herbicides wisely; follow label precautions. For greatest safety, do not use spray equipment for any other materials after you have used it for herbicides.

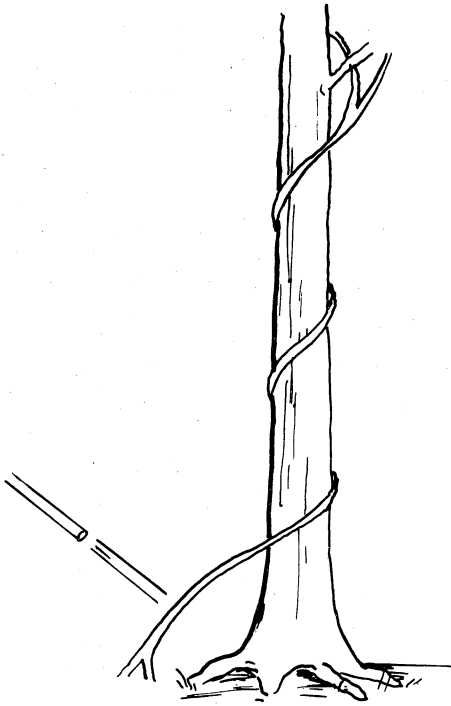


Figure 4. Spray lower stem and root crown of climbing vines. Basal spraying of trees less than 4 inches in diameter is done in the same manner.

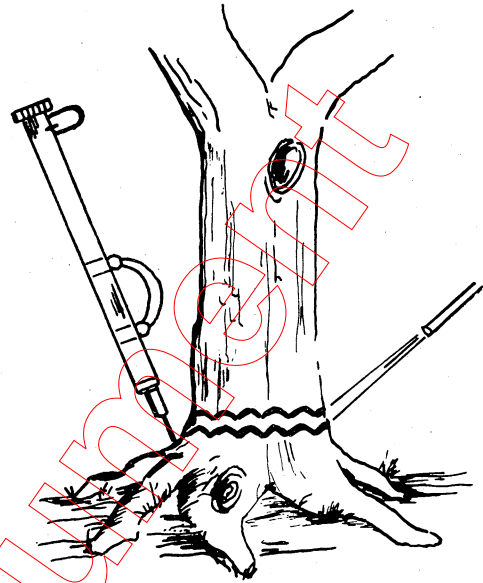


Figure 5. Hack a deep overlapping frill. Spray to overflowing with recommended chemical-oil mixture (right). Or, use tree injector to make frill and apply chemical-oil mixture (left).



Figure 6. Hack frill above stump wounds or seams on injured trees and apply chemical-oil mixture.

For Further Assistance

In many counties cost sharing payments may be earned by the woodland owner for timber stand improvement work through the County Agricultural Stabilization and Conservation Service (ASCS) under their program. The work must be approved by the county ASC committee. Also, the work will not be approved for payment unless the woodland is protected from fire and grazing.

Consulting foresters, located throughout the State, may be available to do your timber stand improvement work for you. A list of these consultants can be obtained from your nearest forester or the Department of Forestry and Conservation at Purdue University.

For additional information contact your county agent, soil conservation district office, or district service forester.